

#8

Docket No. 60,130-1303  
01MRA0194

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re application of: Wurm, et al.  
Serial No.: 10/023,479  
Filed: 12/13/2001  
Examiner: Unknown  
Group Art Unit: 3612  
For: METHOD OF ASSEMBLING A DOOR



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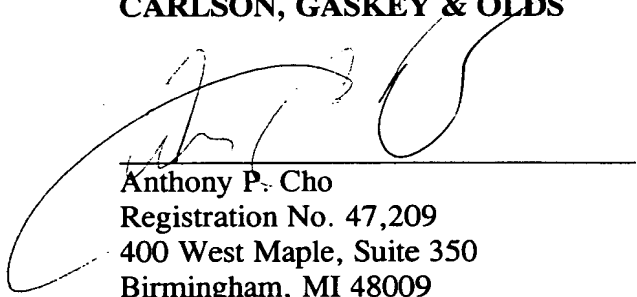
Assistant Commissioner for Patents  
Washington, D.C. 20231

Dear Sir:

With regard to the above-referenced patent application, enclosed is a Certified Copy of United Kingdom (GB) Application Number 0030529.2 filed 14 December 2000, from which priority is claimed pursuant to 35 U.S.C §119.

Respectfully submitted,

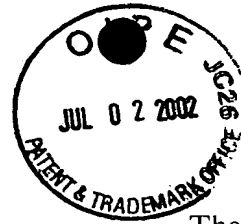
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Dated: June 25, 2002

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INVESTOR IN PEOPLE

The Patent Office  
Concept House  
Cardiff Road  
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NP10 8QQ

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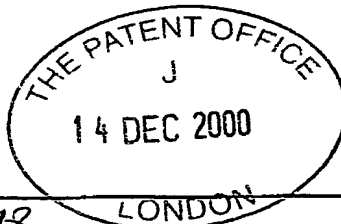
# The Patent Office

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0030529.2

## Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)



14 DEC 2000

Cardiff Road  
Newport  
South Wales  
NP10 8QQ

1. Your reference P301498GB/45998

2. Patent application number  
(The Patent Office will fill in this part)

0030529.2

3. Full name, address and postcode of the or of each applicant (underline all surnames)

Meritor Light Vehicle Systems - France  
105 Route d'Orleans  
B.P. 48  
Sully-sur-Loire  
45600  
France

15DEC00 E591581-3 D01038  
P01/7700 0.00-0030529.2

Patents ADP number (if you know it)

07992480001

If the applicant is a corporate body, give the country/state of its incorporation

United Kingdom

4. Title of the invention

Method of Assembling a Door

5. Name of your agent (if you have one)

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

WITHERS & ROGERS  
Goldings House  
2 Hays Lane  
London  
SE1 2HW

Patents ADP number (if you know it)

1776001✓

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or each of these earlier applications and (if you know it) the or each application number

Country

Priority application number  
(if you know it)

Date of filing  
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing  
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (answer 'Yes' if:

a) any applicant named in part 3 is not an inventor, or  
b) there is an inventor who is not named as an applicant, or  
c) any named applicant is a corporate body.  
See note (d))

YES

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Description 10

Claim(s) 2

Abstract

Drawing (s) 7

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77) One

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

11.

I/We request the grant of a patent on the basis of this application.

Signature *W. H. Jones* Date 14/12/2000

12. Name and daytime telephone number of person to contact in the United Kingdom

John B. Jones

0121 245 3900

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After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least six weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

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### Method of Assembling A Door

The present invention relates to a method of assembling a door and a method of assembling a vehicle including a door. In particular the invention relates to a method of assembling a car (automobile) door.

Known car doors are typically assembled by welding various strengthening and reinforcement elements to an inner panel and then attaching an outer panel to this subassembly by a hemming technique. This bare door is then allocated to a car body along with other bare doors and a bare bonnet and a bare boot and this set of components is then painted together to provide the final exterior colour for the vehicle. Such a technique ensures that all exterior surfaces of the vehicle are of uniform colour since the final coat of paint on all panels is from the same batch of paint.

Subsequently the functional hardware is then installed through holes in the inner panel into the painted doors and water management membrane is applied to this inner panel to close the various access holes.

Finally, a trim panel is fixed to the inner panel to provide a styled aesthetically pleasing surface which incorporates appropriate features such as switches, door pockets, loudspeakers and heater grills.

Thus the assembly of the door components into the door is from the inside (when considering the associated vehicle). Such an assembly method means that the various door components must be assembled into the door on the vehicle assembly line since:-

- a) all exterior panels are painted together and
- b) the door components must be assembled after painting.

An object of the present invention is provide improved method of assembling a door.

Thus according to the present invention there is provided a method of assembling of a door comprising the steps of providing:-

A door inner panel having an outer face and an inner face

At least one functional component of the door

An anti intrusion beam

And a door outer panel,

Assembling said at least one functional component towards the outer face, assembling the anti intrusion beam towards the outer face together with or prior to assembling the door outer panel towards the outer face, and securing via fixing means the door inner panel, said at least one functional component, the anti intrusion beam and the door outer panel relative to each other.

Advantageously this allows for the majority of the door components to be assembled onto the door (in particular at a door assembly line) prior to a door outer panel being secured to the door.

The invention will now be described, by way of example, with reference to the accompanying drawings in which:-

FIGURE 1 is an exploded view of a door which can be assembled according to the present invention,

FIGURE 2 is an exploded view of the window regulator components of figure 1,

FIGURES 3 to 6 show one method of assembling the door of figure 1, and

FIGURE 7 shows a further embodiment of a door which can be assembled according to the present invention.

When reference to figures 1 and 2 there is shown a door 30, in this case a front left hand door of a car (automobile).

The door is assembled from various components including a door inner panel 31, a window regulator assembly 34 a combined anti intrusion beam and waist reinforcement beam component 36 and a door outer panel 38. Inner panel 31 is in the form of a pressing having an outer face 40 which faces outwardly relative to an associated vehicle and an inner face 41 which faces inwardly relative to an associated vehicle.

Door inner panel 31 includes an upper window frame 42 and a lower portion 43 which together define a window aperture 44. The door inner panel 31 includes various fixing holes 45 a window regulator motor aperture 46, a loud speaker aperture 47, latch fixing holes 48, holes 49 and inside door release handle 50. Typically the inner panel will include reinforcement (not shown) adjacent to front hinge points and also in the region of the latch. A window regulator assembly 34, the components of which are shown in figure 2 is assembled as a subassembly and this subassembly is then assembled towards the outer face 40 of the door inner panel 31 in the direction of arrow A.

Consideration of figure 2 shows the components of the window regulator assembly in detail. A window regulator carrier 1 is provided as a chassis or frame on which is mounted further components of the window regulator assembly. The carrier 1 is in the form of a pressing and includes a 'X' shaped portion having arms 52A, 52B, 52C and 52D which meet at a central region 53. Ends of arms 52A and 52B remote from central region 53 are connected by a substantially vertical portion 54 of the carrier 1. Similarly ends of arms 52C and 52D remote from the central region 53 are also connected by a substantially vertical portion 55.

Arms 52A, 52B, 52C and 52D are all generally elongate and U shaped in cross section as a result of the pressing process.

Carrier 1 includes holes 56 for mounting of the carrier, via fixing means which pass through hole 56 and through corresponding holes 45.

Carrier 1 further includes holes 57 for mounting of cable guides in the form of pulley wheels 4 via rivets 5.

Carrier 1 further includes mounting plate 57 upon which is mounted flexible latch support 18, mounting plate 58 upon which is mounted inner release handle assembly 19, and window regulator drive means plate in the form of a window regulator motor plate 59.

Motor plate 59 is generally planar in shape and is larger than window regulator motor aperture 46 so that seal 15 can provide for a moisture barrier between the interior of the door and the interior of the vehicle.

Motor plate 59 includes a cable drum housing 60.

Front rail 2 and rear rail 3 are mountable in spaced generally parallel relationship on portions 55 and 56 of carrier 1 respectively.

In further embodiments the front and rear rails could be integral with the carrier.

Two cable tensioner 6 and a bare cable separator 7 are also mounted on the carrier and will be further described below.

Window regulator motor 16 is mounted on motor plate 59 via fixing screws 17.

Latch assembly 20 is mounted on flexible latch support 18 which allows for slight adjustment in the position of latch assembly 20 relative to carrier 1 when the window regulator assembly is assembled into the door inner panel.

An inner release handle cable 21 connects inner release handle assembly 19 to latch assembly 20.

A sill button link rod 22 is connected to latch assembly 20 at one end and at another end is connected to a sill button 23.

An outer handle connection 29 operably connects the outer door handle with the latch assembly once the handle has been fitted.

A latch security shield 26 is provided above the latch assembly 20 to prevent unauthorised entry to the vehicle by the use of a 'slim Jim'.

A wiring harness 24 connects various electrical components of the window regulator assembly to the main wire harness of the vehicle (not shown).

For convenience the four pulley wheels 4 have been labelled as a first upper (1U), a first lower (1L), a second upper (2U) and a second lower (2L).

A bare cable assembly 62 is provided and includes a lower cable 11 which connects cable drum 8 to the front cursor 13, an upper cable 10 which connects the cable drum 8 to the rear cursor 14, and an intermediate cable 12 which connects the front cursor 13 to the rear cursor 14.

One end of lower cable 11 is wound around the threaded exterior of drum 8 and secured thereto.

One end of cable drum 10 is also wound around a different portion of the threaded exterior of cable drum 10 and secured thereto.

Window glass assembly 25 includes fixings for securing the lower edge thereof to the front and rear cursors 13 and 14.

In use drum 8 is mounted on bush 9 in driving connection with motor 16.

Rotation of the drum 8 by the motor in one direction will cause lower cable 11 to be wound onto the drum and upper cable 10 wound off the drum causing cursors 13 and 14 and hence the window to lower.

Conversely rotation of the drum in the opposite direction by the motor will cause upper cable 10 to be wound onto the drum and lower cable 11 to be wound off the drum resulting in raising of the window glass 25.

It can be seen that the upper cable 10, lower cable 11 and intermediate cable 12 define a cable path which runs between the various pulley wheels 4 and includes a first cable path portion connecting the first upper cable guide to the first lower cable guide, a second cable path portion connecting the second upper cable guide to the second lower cable guide, a first further cable path portion connecting the first upper cable guide to the second lower cable guide and a second further cable path portion connecting the first lower cable guide to the second upper cable guide. Note that the first and second cable path portions are substantially vertical and are substantially parallel to the front and rear rails 2 and 3 which define the direction of vertical movement of the window glass 25. Furthermore the first further portion and second further portion together form a 'X' shape. Note that the second further portion is defined by the portion of the lower cable 11 running between the first lower cable guide and the drum (but not around the drum) in combination with that portion of the upper cable 10 running between the second upper cable guide and the drum (though not around the drum).

In view of the fact that the cable arrangement is a bare cable arrangement, it is necessary to ensure a minimum level of tension in all cables 10, 11 and 12 to ensure that they remain in place on appropriate pulley wheels and cable drum. Depending upon where the window glass is positioned e.g. fully closed with the glass in engagement with the glass run, part open, or fully open with part of the window regulator assembly being engaged with a lower stop, then this determines the various tension levels within the cables 10, 11 and 12, together with the two tensioner springs 6. In view of the fact that arms 52A, 52B, 52C and 52D extend to at least the mounting point of the pulley wheels 4 as do portions 54 and 55, then the carrier forms a triangulated structure at each of the pulley wheels where the tension in the cables 10, 11 and 12 is reacted.

In view of the fact that the first further and second further cable path portions cross and further in view of the fact that as cable drum 8 rotates and that portion of cable 10 which is being wound onto or off from the cable drum moves laterally relative to the door then it can be seen that advantageously a bare cable separator 7 can be mounted at the central region 3 of the carrier 1 in order to guide cable 10 past cable 12 to ensure that they do not 'saw' against each during to the raising and lowering of the window glass 5.

The components as shown in figure 2 can all be pre assembled to form the window regulator assembly 34.

Component 36 is formed as a single pressing and includes an anti intrusion beam 64 designed to prevent intrusion into the vehicle of parts of other vehicles and the like in the event of a road traffic accident.

The component 36 further includes a waster level reinforcement beam which in use supports the upper edge 38A of door outer panel 38 the other edges of door outer panel 38 being supported by the door inner panel.

The component 36 includes fixing holes 65 which co-operate with holes 49 and fixings 66 to secure the component 36 to the inner panel 31.

One method of assembling the door 30 is as follows:-

Inner panel 31 is placed horizontally on a jig such that inner face 41 faces downwards and outer face 40 faces upwards (through the door need not be assembled 'horizontally').

The inner waist line seal 69 and glass run 70 are moved to position (see arrows B and C) and secured on the door inner panel 31 at the periphery of the window aperture 44.

Loudspeaker 71 is moved to position (see arrow D) and is secured to the door inner panel 31 by four screws 72 which are tightened by the assembly operator from above i.e. in a direction facing the outer face 40 (when on the jig faces upwards).

The window regulator assembly 34 is then moved to position in the direction of arrow A and secured in place by screws (not shown) which are screwed into holes 45 from above. The component 36 is then moved to position in the direction of arrow E and fixings 66 are used to secure it to the door inner panel (as described above).

Outer waist line seal 73 is mounted on upper edge 38A of outer panel 38 and this subassembly is then moved in the direction of arrow F and is secured to the door inner panel 31.

In particular it should be noted that the various components of the door are assembled from the outside and this is contrary to known assembly methods where such components are assembled into the door from the inside.

It should also be noted that in view of the motor plate 59 and seal 15, the motor 16 is on the 'dry' side of the door since any moisture or rain entering the lowering portion 43 of the door via the outer waist line seal 73 is prevented from progressing through aperture 46 by seal 15.

Figures 4 to 6 show the manner in which the door is assembled.

Various fixings can be used to secure the various components.

Bolts and screws and other similar threaded fasteners have an assembled axis e.g. the longitudinal axis of the bolt or screw. Furthermore they have an assembly direction defined by the bolt head or screw head. Thus the assembly direction of a screw is from the screw head to the screw point. Thus where such fixings are used the assembly direction can be towards the outer face 40 i.e. inwardly relative to the associated vehicle.

Typically known vehicle doors include fixings having assembly directions which are orientated outwardly relative to the vehicle.

In particular bolts and screws are releasable fixing means.

An alternative fixing means which can be used is a pop rivet which also has an assembly axis and an assembly direction.

Alternative fixing means include adhesive bonding of one component to another or alternatively welding of one component to another.

Furthermore a known method of securing an outer panel to an inner panel is to 'hem' the edge of the outer panel i.e. to deform it around the corresponding edge of the inner panel.

It should be noted that bolts and screws are generally removable so that components being secured by the bolts or screws can be separated without damage to either component. Furthermore pop rivets can be drilled out in order to separate two components again without damage to either component.

Depending upon the design, the adhesive bond between two components can be broken without damage to either component.

However, welding of one component to another component provides a fixing means which prevents the components being separated without damage to one or other component. Furthermore where components are welded together, such welding techniques generate extreme amounts of heat and hence this is not a fixing technique which is suitable for refixing a component within a partially assembled door.

Similarly where an outer panel has been hemmed onto an inner panel it is not possible to break the hemmed joint without damaging the outer panel such that it can no longer be reused. Advantageously the fixing means used to secure the various door components allows the various door components to be non destructively separated and also reconnected.

It should be noted that the non destructive separating of components as mentioned herein refers to the non destruction of the components per se and not to be the non destruction of the fixing means. Thus components fixed by an adhesive joint can be non destructively separated without damage to either component whilst nevertheless destroying the adhesive per se. Under these circumstances new adhesive has to be used to reconnect the two components.



Where the door 30 has been assembled using non destructive type fixing means then it is possible to:-

- a) remove a damaged outer panel and replace with a new outer panel,
- b) remove both a damaged outer panel and a damaged component 36 and replace with a new component 36 and new outer panel,
- c) remove an undamaged outer panel and remove an undamaged component 36 in order to gain access and repair other components of the door such as the window regulator assembly (and in particular replace a broken window glass), replace a damaged loudspeaker, or replace a damaged latch.

In further embodiments the component 36 can be formed as a subassembly from an anti intrusion beam and a waist level reinforcement beam. As such in the event that just the anti intrusion beam is damaged then it can be replaced independently of the waist level reinforcement beam and vice versa.

Furthermore such a subassembly or component 36 can form part of a subassembly with the door outer panel.

A car manufacturer is typically supplied with various car components by component suppliers. The components themselves can be individual items (such as nuts or bolts) or alternatively they can be subassemblies such as engines, gearboxes, axles, bonnets (hoods), boot lids (trunk lids), body shells or doors.

With regards to body shells, bonnets, boots and doors, it is important that the exterior surfaces of these components, of a particular vehicle are all painted with paint from the same batch, in order to avoid slight variations in colour.

Clearly the major exterior coloured surface of the door 30 is the exterior surface of the door outer panel 38. It is possible to paint the exterior surface of the upper window frame in a neutral colour, such a black, without significantly affecting the exterior aesthetic appearance of the vehicle as a whole. Thus an alternative method of assembling the door is as follows.

All of those components as shown in figure 5 can be assembled together to form a door subassembly 76 (see figure 6) this can be carried out at a door manufacturers assembly line (also known herein as a first assembly line).

The door outer panel can be provided at the car manufacturers assembly line (also known herein as a second assembly line) wherein it can be allocated to a specific car body shell alongwith other doors and a bonnet and boot. This set of components can then all be painted simultaneously with paint from the same batch to ensure uniform colour.

The door assembly 76 can then be transported from the door assembly line to the vehicle assembly line where the outer panel can be assembled onto the door and the door can be assembled onto the associated vehicle. Note that the order in which the door outer skin is assembled on to the door and the door is assembled onto the associated vehicle can be carried out in either order.

Note that the door assembly 76 can have various levels of equipment e.g. with or without loudspeaker, with a window regulator motor or with a manual window regulator winder, with a manual only latch arrangement or with a electronic central door locking latch arrangement.

Furthermore there may be several different types of door outer panel at the vehicle assembly line most notably outer panels of differing colour e.g. red, green and blue but also outer panels of differing shapes for fitment onto different car models having a substantially common floor plan.

Furthermore there may be several different inner trim panels at the car assembly plant. Thus by way of example if there are three different door subassemblies 76, four different outer panels  $3 \times 4 \times 5 = 60$ ). It can be seen that where a door manufacturer has a first assembly line and a car manufacturer has a second assembly line the door manufacturer only has to supply three different types of doors to the car manufacturers assembly line. This has significant logistic advantages.

## Claims

1. A method of assembling of a door comprising the steps of providing:-  
  
A door inner panel having an outer face and an inner face  
At least one functional component of the door  
An anti intrusion beam  
And a door outer panel,  
  
Assembling said at least one functional component towards the outer face, assembling the anti intrusion beam towards the outer face together with or prior to assembling the door outer panel towards the outer face, and securing via fixing means the door inner panel, said at least one functional component, the anti intrusion beam and the door outer panel relative to each other.
2. The method of claim 1 in which the at least one functional component of the door is assembled and secured prior to assembly of the anti intrusion beam or door outer panel.
3. The method of claim 1 or 2 in which the anti intrusion beam is assembled and secured prior to assembly of the door outer panel.
4. A method of assembling a door according to any preceding claim further including the steps of providing a trim panel, assembling the trim panel towards the inner face and securing the trim panel by fixing means.
5. A method of assembling a door according to any preceding claim in which the fixing means includes at least one fixing element which is assembled towards the outer face.
6. A method assembling a door according to claim 5 in which the fixing element includes a primary axis which is positioned substantially perpendicular to the outer face.
7. A method of assembling a door as defined in claim 6 in which the fixing means includes a primary fixing direction which faces the outer face during assembly.
8. A method of assembling a door according to any preceding claim in which the door outer panel is non destructively releasably fixed by the fixing means.
9. A method of assembling a door as defined in claim 8 in which the door outer panel is non destructively releasably fixed by fixing means in the form of an adhesive.
10. A method of assembling a door as defined in any preceding claim in which the fixing means are non visible when the door is in use and is closed.

11. A method of assembling a door as defined in any preceding claim in which the anti intrusion beam is non destructively releasably fixed by the fixing means.
12. A method of assembling a door as defined in any preceding claim including the step of providing a subassembly of:- the door inner panel, said at least one functional component of the door and the anti intrusion beam.
13. A method of assembling a door into a car body comprising the steps of providing a subassembly as defined in claim 12 on a first assembly line, providing a car body on a second assembly line, providing the door outer panel on the second assembly line, moving the subassembly from the first assembly line to the second assembly line, fixing the subassembly onto the car body, and fixing the door outer panel onto the subassembly.
14. A method of assembling a door onto a car body as defined in claim 13 in which the subassembly provided at the first assembly line further includes a trim panel.
15. A method of assembling a door as defined in claims 13 including the step of providing a trim panel at the second assembly line and after the subassembly has been moved to the second assembly line fixing the trim panel on the subassembly.
16. A method of assembling a car door onto a car body as defined in any of claims 13 to 15 including the step of providing a plurality of different door outer panels at the second assembly line and selecting one of said plurality to assemble onto the door.
17. A method of assembling a door as defined in claim 16 in which the plurality of door outer panels at least differ in their shape.
18. A method of assembling a door as defined in claims 16 or 17 in which the plurality of different door outer panels at least differ in their colour.
19. A method of assembling a door onto a car body as defined in claim 15 including the step of providing a plurality of different trim panels and selecting one to assemble onto the door.

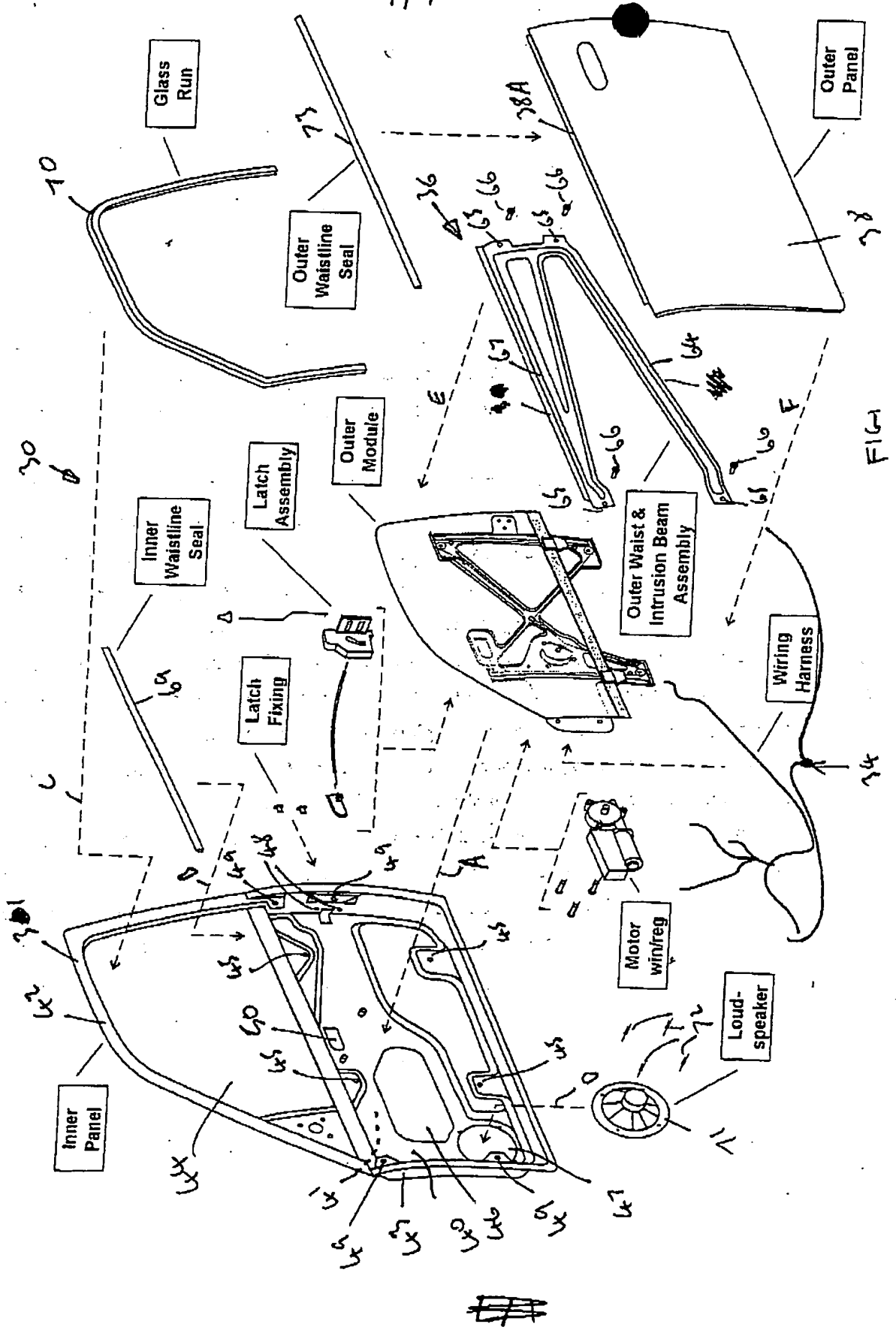


FIG 1

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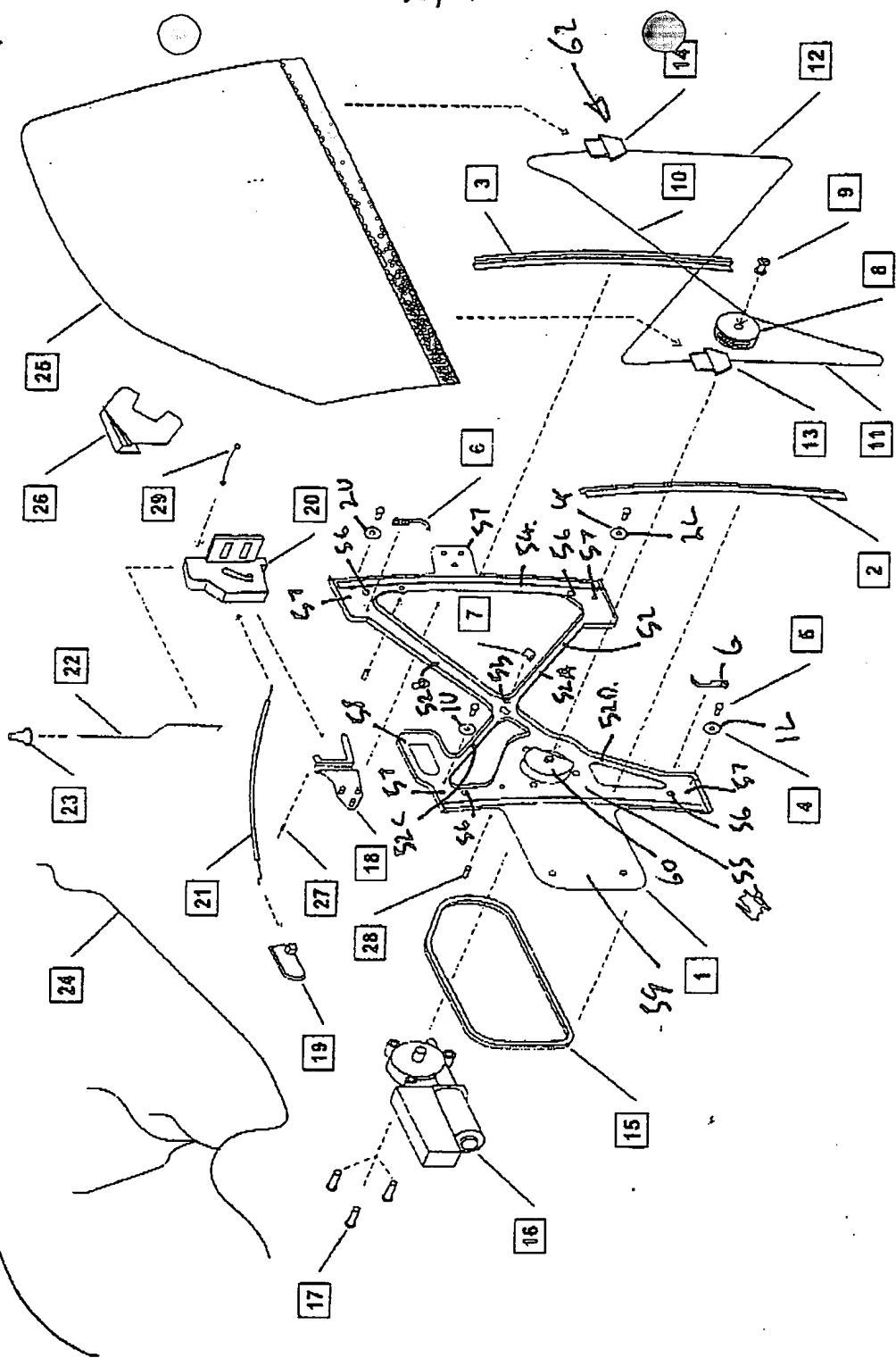


FIG. 2.

Spare

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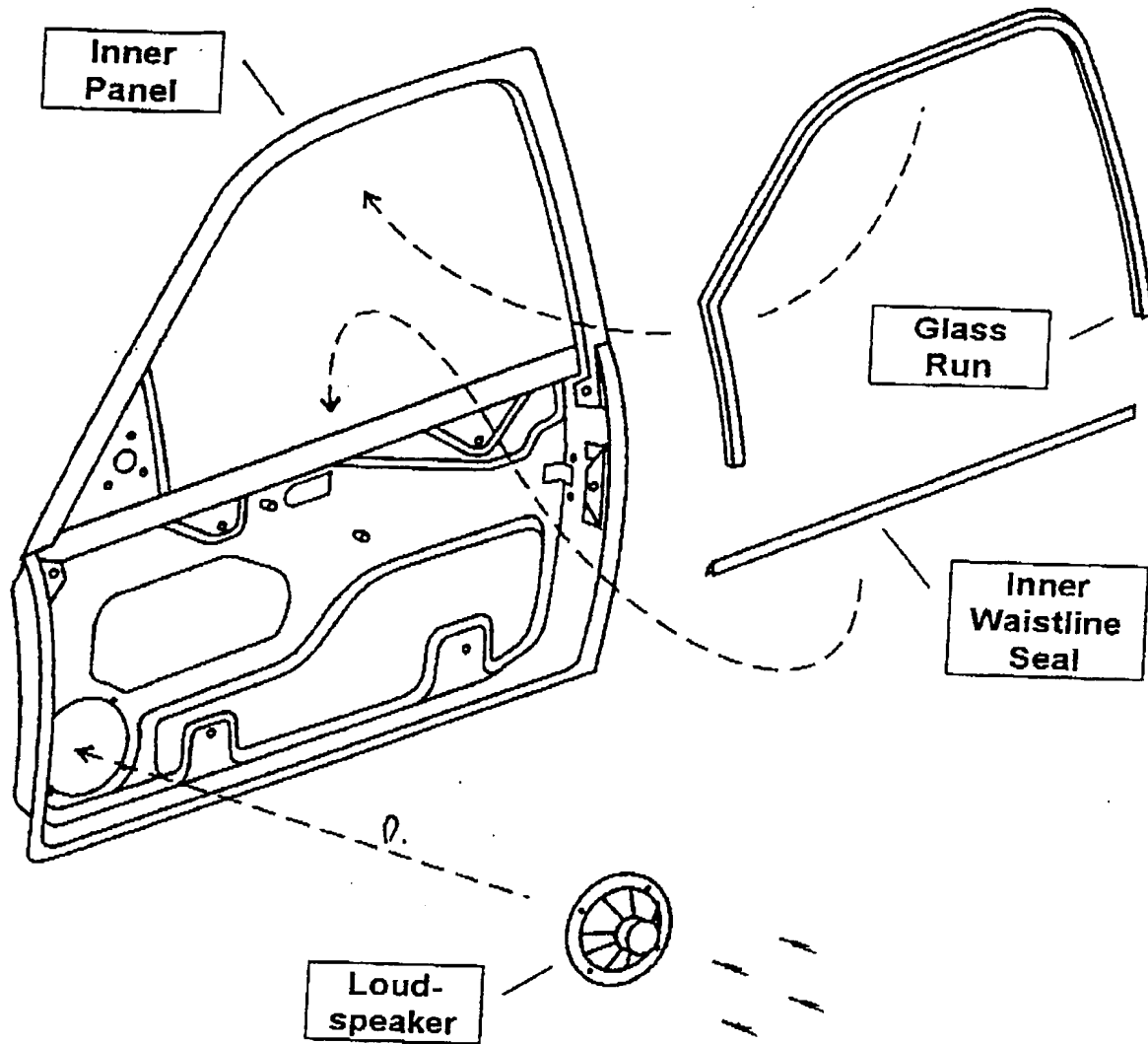


FIG 3

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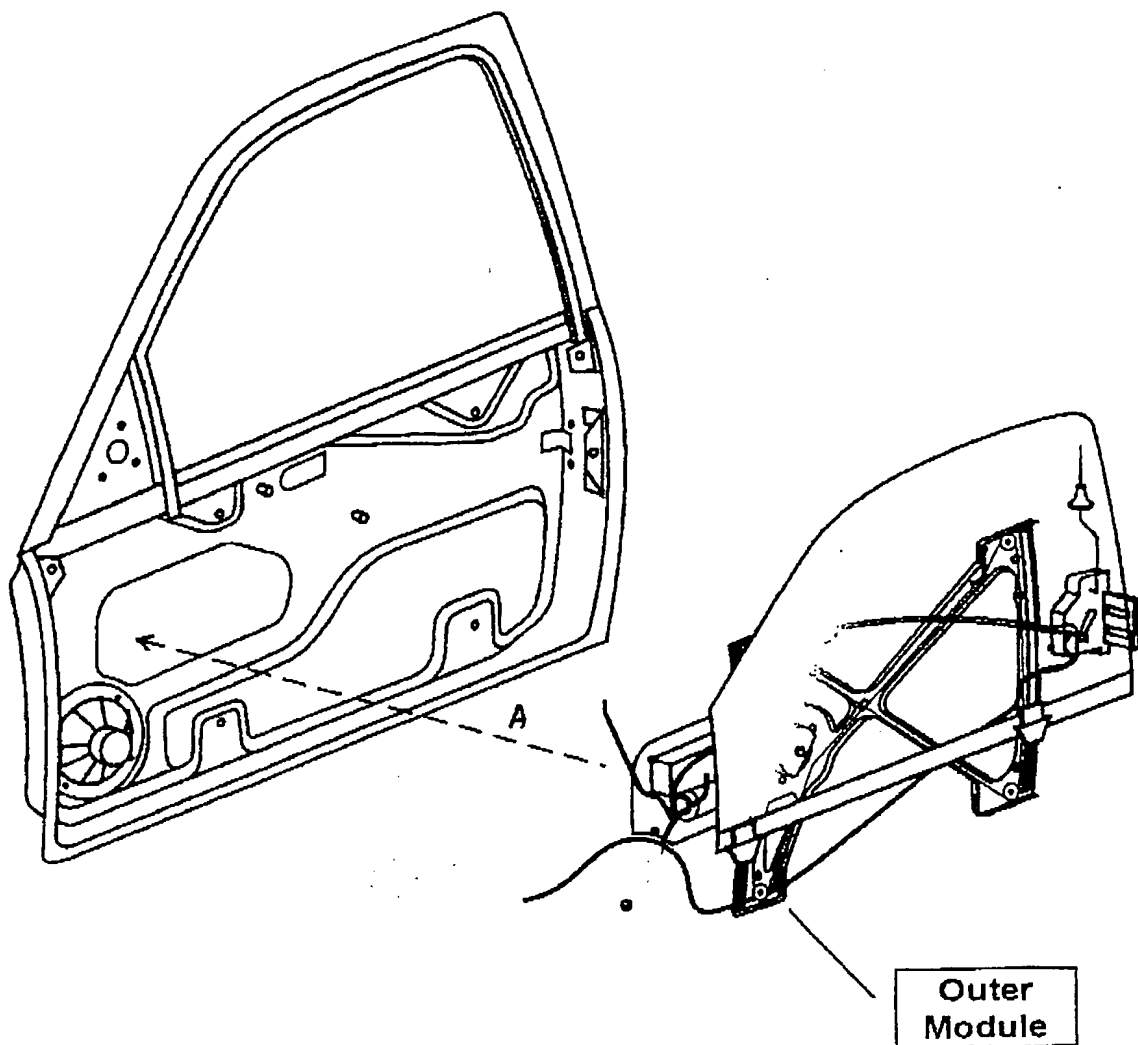


FIG 4

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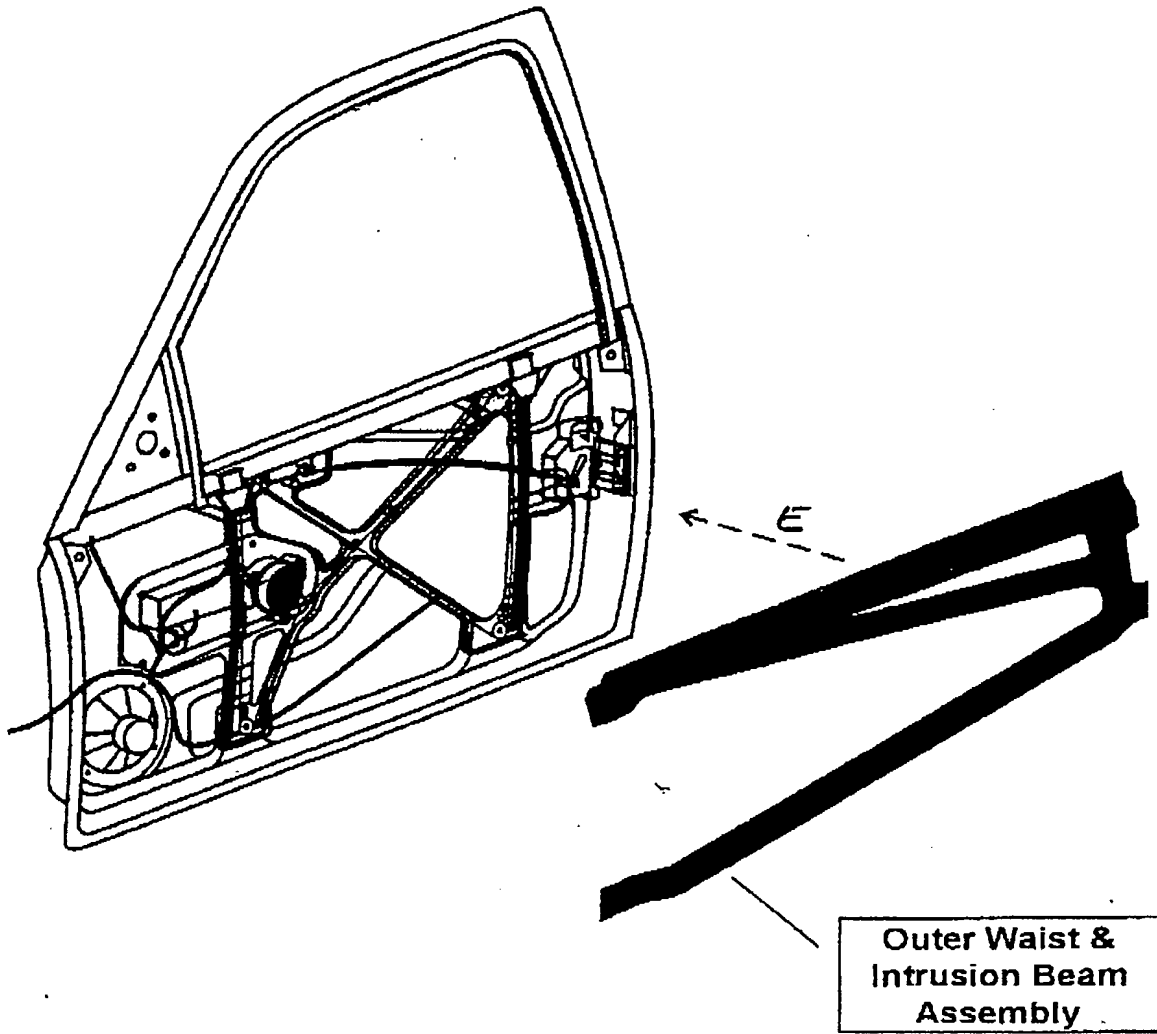


FIG 5

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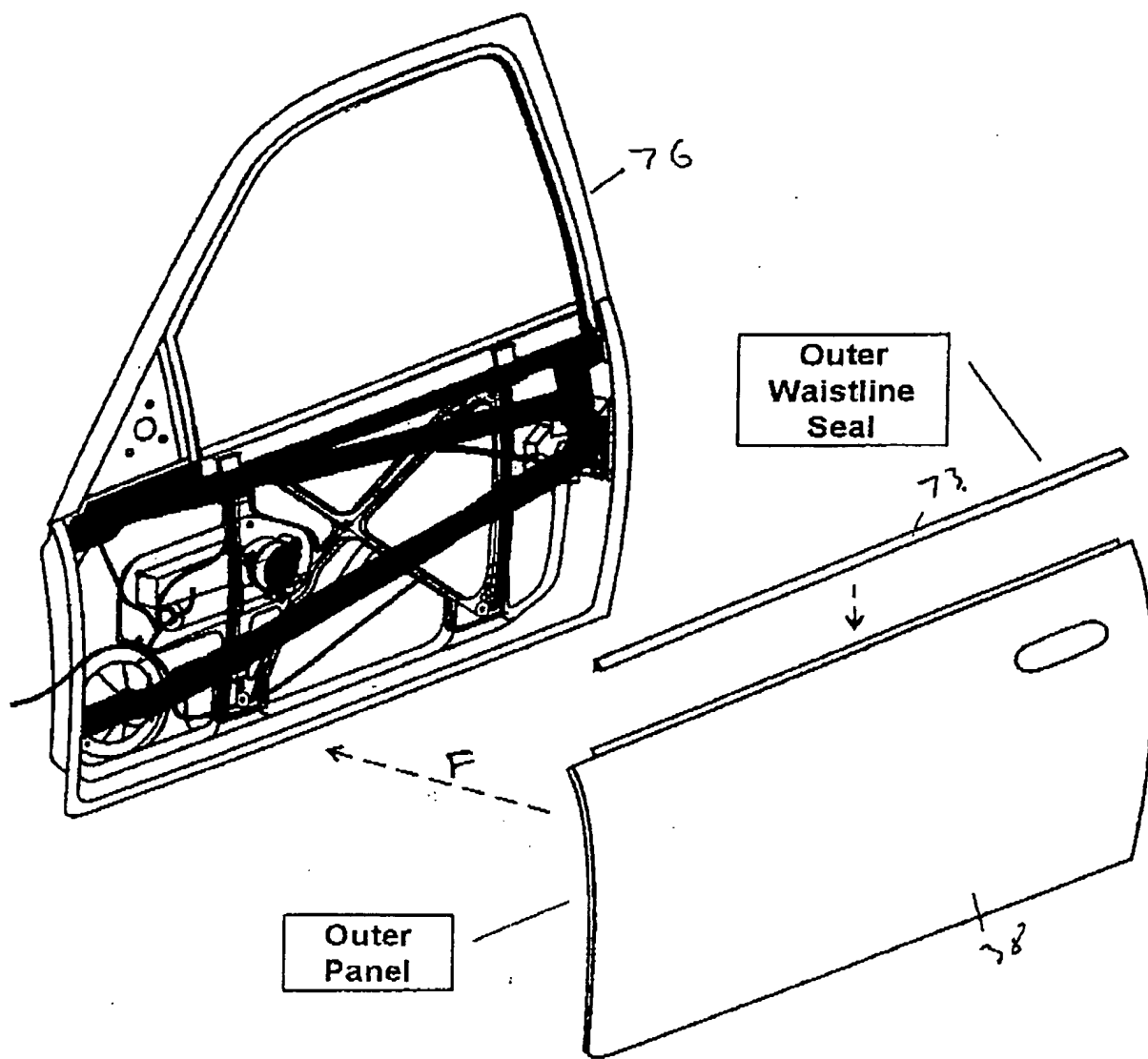


FIG. 6.

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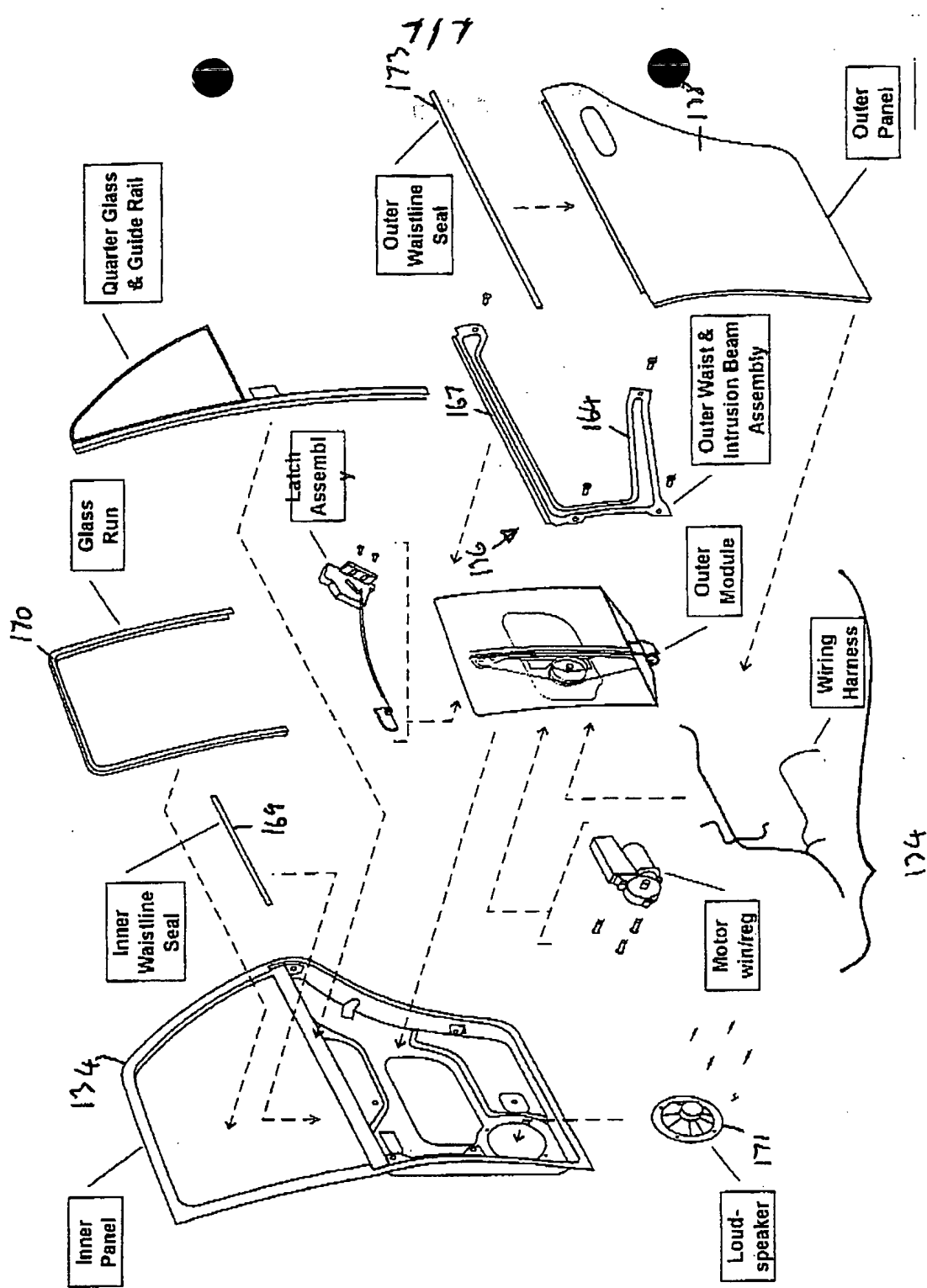


FIG. 7.

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